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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/502,340	02/10/2000	Robert H. Fuerhoff	MEMC 99-0900 (2632)	5009

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SENNIGER POWERS LEAVITT AND ROEDEL
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER

ANDERSON, MATTHEW A

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 04/02/2003

20

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/502,340

Applicant(s)

FUERHOFF ET AL.

Examiner

Matthew A. Anderson

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 27 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 1-6,9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cope (US 3,761,692).

Cope discloses a method of pulling a Si ingot with the Czochralski crystal puller under controlled conditions. The pull parameters under control are the generator power output, the crystal pull rate, the crystal spin rate, the crucible lift rate, and the crucible spin rate. The spin rates are kept constant at a set point. The temperature is related to the generator power output by a temperature control algorithm (see col. 4 lines 56+) which reads on definition of a temperature model representative of variations in the temperature of the melt in response to variations in power supplied by the heater for heating the melt. The pull rate of the method is controlled to maintain the crystal pull rate specified by the diameter control algorithm (See col. 5 lines 1-11). This reads on pulling at a target rate which substantially follows a set velocity profile. The diameter of the pulled crystal is sensed (col. 5 line 1) as is the melt temperature (col. 7 lines 50-57). The temperature is adjusted to maintain the average pull rate within imposed limits.

These imposed limits define the set velocity profile. The temperature control is described in col. 20 and lines 1-6 of col. 21. In lines 25-45 is described the PID control of temperature in which an error is compared to upper and lower limits. A new set point is determined therefrom. The temperature error and the power output error are both involved in these determinations. The power is then adjusted if required. The power was known to affect the temperature within the device. The result is shown in Fig. 9 where constant diameter growth is achieved. The temperature control algorithm is performed every 45 seconds. Thus, the power is pulsed to the heater when the temperature must be raised. Fig. 1 shows a computer connected to the apparatus used.

Cope differs from the present invention only in that PID control is also performed by Cope on the pull rate. The examiner notes that the pull rate adjustment reads on the application's substantially following a set velocity profile because the average pull rate profile of Cope is determined by the upper and lower imposed limits thereon.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to perform pulling growth of a Cz monocrystalline ingot as in claim 1 of using memory stored velocity profiles because such a method of PID controlled Cz pulling was suggested by Cope as described above. The examiner notes the use of computer (i.e. memory device) control was suggested at least in Fig. 1.

In reply to claims 2-5, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the power input to the heater would be pulsed at an amplitude greater than steady state and of a set duration because Cope

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limits the temperature control algorithm to run every 45 seconds and heaters can only add heat.

In reply to claims 2-6, it would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the power output set point and the power pulse duration because Cope discloses such power output optimization and the duration of power output would be determined by the increase in temperature needed, such optimization would have been achieved by only routine experimentation, and such optimization would have been anticipated to produce an expected result.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to vary the pull rate to control the ingot diameter because Cope discloses such variation at all stages of the ingot pulling process

It would have been obvious to one of ordinary skill in the art at the time of the present invention that the temperature model would include measuring changes in temperature of the melt because Cope discloses sensing the temperature of the melt .

3. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cope as applied to claims 1-6, 9-10 above, and further in view of Araki et al.(US 5,089,238).

Cope is described above.

Araki et al. discloses a method of growing Si ingots by the Czochralski method. In col. 2 lines 25-40, it was disclosed that the responsiveness of the diameter to temperature fluctuations was slower than pull rate control of diameter.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the references because both disclose temperature control of diameter of ingots pulled by the Cz process.

In reply to claims 7-8, it would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize a delay period, a gain, and a lag function because Cope et al. discloses delay between runs of the control algorithms, power gains required to restore the temperature to the desired set point, Araki et al. discloses a lag between temperature control and response of the diameter and such optimization would have been achieved by routine experimentation

Response to Arguments

Applicant's arguments filed 1/27/2003 have been fully considered but are not persuasive.

The argument that the Cope "diameter control algorithm" is not a "velocity profile" stored in memory is not convincing since both are stored in a computer. If the velocity profile deviates from the upper and lower boundaries, then the pull rate is changed.

Cope had a pull rate. Thus it was set to something to begin with. The applicant's upper and lower boundaries are merely very nearly the same value.

The argument that the Cope reference teaches away from the present invention is not credible. The examiner notes the cited passages do not require that the pull rate

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be continuously changed; only that it be controlled. (see col. 10 lines 45+ and col. 12 lines 1-5.)

Again the examiner must insist that the pull rate is initially set to something. No evidence of any unexpected results has been given.

The argument that setting the average pull rate to x would alter the operation of Cope's invention is not convincing. No limitation is given by Cope that this setting of pull rate is prohibited. Pull rate is only one of many result effective variable which is described as controlled.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
April 1, 2003


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